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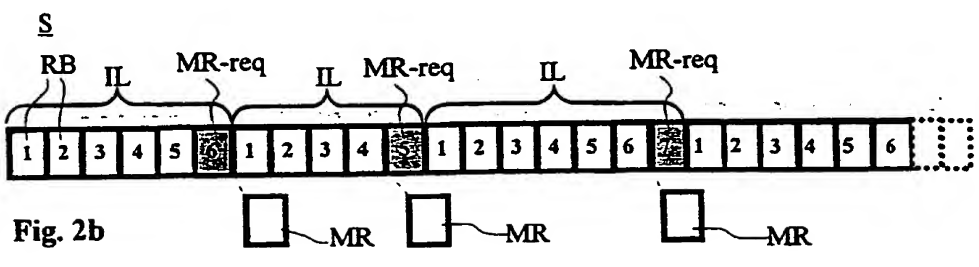

Fig. 2b

(57) Abstract: The present invention relates to a mobile radio network that includes a packet service. The invention also relates to a method for controlling transmission quality over the radio connection downlink. This quality control is effected by receiving mobile terminal measurements. Measurement reports (MR) are sent in uplink at given intervals (IL). According to the method, the interval (IL) is varied in accordance with variations in transmission quality. The invention also relates to a packet control unit (PCU) that includes means for requesting measurement reports at intervals which are varied in accordance with the information contained in received measurement reports.

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METHOD AND ARRANGEMENT RELATING TO MOBILE PACKET NETWORKS

FIELD OF INVENTION

The present invention relates to an arrangement and to a method pertaining to mobile radio networks for supporting a packet service, and for monitoring the transmission quality of radio connections with mobile stations in the network.

DESCRIPTION OF THE BACKGROUND ART

A cellular mobile radio system enables users of mobile stations included in the system to setup call connections with the stationary part of the network through the medium of radio connections. The transmission quality of a radio connection with a given mobile station will vary depending on the location of the mobile station. Topography, the nearness to disturbance sources, and the distance of the radio connection, all influence the quality of a radio transmission link. The transmission quality changes as the mobile station moves geographically.

In order to maintain the transmission quality of an ongoing call, the quality of the radio connection is checked during the entire duration of the call. If the quality is found to be excessively poor, the connection is switched to another radio channel.

The radio connection is a duplex connection, in other words the connection is divided into a downlink connection from a radio base station in the fixed or stationary part of the mobile radio network to the mobile station, and an uplink connection in the opposite direction. Respective uplink and downlink connections use mutually separate radio channels. Transmission quality may be different for the uplink and downlink respectively and must therefore be checked *per se*.

The transmission quality of the uplink connection is determined in the radio base station and the transmission quality of the downlink connection is determined by the mobile station. The measurements obtained are combined in the mobile station at certain intervals, in a measurement report transmitted on uplink. The measurement report and the result of the measurements on the uplink connection are sent from the radio base station to another node in the stationary part of the mobile radio network. In the case of the well known GSM-system, the measurements are sent to a base station controller for evaluation or estimation.

In mobile radio networks constructed in accordance with the TDMA-principle, a physical radio channel, that is to say a given time slot on a given carrier frequency, is divided into a number of logic channels. The logic channels obtain access to the physical channel in accordance with a strict schedule that is repeated cyclically. This is necessary in order for the receiver to know which type of logic channel has been received and to process the received data correctly.

Each logic channel transmit a certain type of information. The logic channel that has the greatest access to the physical channel is the traffic channel. This channel transmits information, e.g. speech, between users. Another logic channel used to transmit measurement reports from the mobile station in the uplink connection is referred to in the GSM-system as the slow associated control channel (SACCH). Both the traffic channel and SACCH use a physical channel that is dedicated for the connection to the mobile station. Thus, the interval in which measurement reports are sent in uplink is controlled by the frequency in which the SACCH channel is given access to the physical channel in accordance with the schedule.

A granted patent, U.S. 5,335,356, addresses a problem concerning the overloading of a microprocessor in a node in the stationary part of a mobile radio network. The node is comprised of a radio base station or a switching centre and functions to evaluate the transmission quality of radio connections together with the microprocessor included in the network. This evaluation is based on the result of measurements on each of these connections and leads to a change of radio channel in respect of one or more of the connections. The traffic load varies stochiometrically, and particularly in peak load hours there is an imminent danger that the capacity of the processor will not be sufficient to meet prevailing requirements. The node and the processor also have other traffic monitoring and controlling functions, which suffer when the processor is overloaded. U.S. 5,335,356 provides a solution to this problem, wherein the interval in which the microprocessor evaluates the transmission quality of a given radio connection varies in relation to the result of earlier evaluations of the measurement result.

Work is at present on hand within standardisation commissions for the GSM-system to standardise a new packet service called GPRS (General Packet Radio Service). Distinct from a circuit switched connection, a physical channel used for GPRS is available for transmission to or from a plurality of mobile stations. Thus, a number of mobile stations in downlink listen to a given channel in order to discover whether any of the packets sent over said channel are intended for the own mobile.

Similar to packet switching over a fixed network, the receiver sends a response to the transmitter informing the transmitter whether the content of the received packet is correct or not. The mobile station is the receiver in downlink and sends in uplink a response in the form of an ACK/NACK message (acknowledge/not acknowledge). The mobile

station also sends in the ACK/NACK message a measurement report concerning the transmission quality in respect of a measurement period corresponded by the received packet/packets.

Thus, in the case of radio channels used for GPRS, the schedule used for mapping logic channels on physical radio channels is different to that used in traditional circuit switched connections in GSM.

According to GPRS, the measurement report is sent to a packet node (Packet Control Unit) for evaluation of the transmission quality. GPRS affords a new further possibility of adapting the radio connection to prevailing radio environments in order to maintain desired transmission qualities. This new feature resides in the availability of four different alternative coding procedures for preventing wrong interpretation of information on the radio link as a result of disturbance. Earlier, one and the same coding procedure has always been used for the radio connection. In difficult radio conditions, there is used a coding procedure that affords good protection to the transmitted information. This good protection, however, is achieved at the price of increased data redundancy and therewith in a lower transmission capacity. In good radio conditions there is used a coding procedure that gives lower data redundancy and therewith good transmission capacity on a given channel. Thus, in order to maintain correct transmission quality through the selection of a coding procedure it is necessary to achieve a balance between mutually contradictory performance requirements.

Operators of mobile radio networks according to American standards, e.g. ADC (American Digital Cellular), intend to include GPRS in their networks.

SUMMARY OF THE INVENTION

The present invention addresses a problem caused by the necessity of the terminal to constantly send measurement reports at close intervals in order to maintain sufficiently good transmission quality on a radio channel to a mobile terminal also when radio environments rapidly change, for instance as a result of movement of the terminal. Measurement reports take some of the resources of the radio channel from other information to be transmitted over said channel. The transmission of measurement reports is also a drain on battery capacity.

Accordingly, one object of the present invention is to limit the number of measurement reports that need be sent from the terminal while retaining the possibility of maintaining sufficiently good quality on the downlink of the radio connection.

The solution is based on the observation that in respect of packet-orientated data services, it is possible to variably control the interval between the measurement reports sent by a given terminal.

According to the present invention, the above problem is solved by means of a method in which the terminal is caused to send measurement reports at an interval selected subsequent to having evaluated measurement reports obtained from the terminal.

The aforesaid problem is also solved by a packet control unit which, during transmission of a packet to a mobile terminal, controls the terminal to send measurement reports in uplink at given intervals, and which includes means for selecting such intervals on the basis of measurement reports obtained during said transmission.

A solution to the problem is also defined in the dependent Claims.

One advantage afforded by the invention is that the speed of link adaptation in respect of downlink is adapted according to the radio environment in which each individual terminal finds itself. By link adaptation is meant evaluation of transmission quality for coding procedure selection and possible handover to a new channel. The radio environment of a rapidly moving terminal can quickly change. In town environments in which so-called street corner effects occur, interference, and therewith radio environment, rapidly changes when the terminal is carried in a vehicle that swings around a street corner. It is important that link adaptation is rapidly implemented in such environments. This means that measurement reports must be obtained at short intervals. Excessively slow link adaptation will mean that this adaptation will not sometimes conform to worsened radio conditions, therewith prevent data from reaching the mobile station. On other occasions, it will mean that data is transmitted with excessive redundancy and that the full capacity of the radio channel cannot therefore be used.

According to the present invention, measurement reports are sent at relatively long intervals in the case of a slowly moving or stationary terminal. One advantage in this respect is that mobile battery capacity is only slightly drained. Another advantage is that a smaller number of measurement reports contributes towards reducing the total interference in the system.

Another advantage is that the operator of the mobile radio network need not adjust the duration of the interval in order to achieve a suitable compromise between different mutually

contradictory performance requirements. This makes the radio network easier to operate.

The invention will now be described in more detail with reference to preferred embodiments thereof and also with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram illustrating nodes that support a packet service in a known mobile radio network.

Figure 2a illustrates a stream of radio blocks in downlink and also a few radio blocks in uplink, in accordance with a known principle.

Figure 2b illustrates a stream of radio blocks corresponding to those in Figure 2a but in accordance with an inventive principle.

Figure 3 is a flowchart illustrating the steps of an inventive method.

Figure 4a is a diagram illustrating a selected coding procedure at different time points.

Figure 4b is a diagram illustrating signal/disturbance ratio at different time points.

Figure 4c is a diagram illustrating the signal variants at different time points.

Figure 4d is a diagram illustrating interference at different time points.

Figure 5 is a block diagram illustrating a packet node modified in accordance with the invention.

Figure 6 illustrates the principle format of a radio block.

Figure 7 illustrates a stream of radio blocks.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 illustrates nodes in a GSM network PLMN that supports a general packet radio service GPRS. The GSM network PLMN includes a mobile services switching centre MSC which is connected to a number of base station controllers BSC. Only one base station controller BSC is shown in Figure 1 for the sake of simplicity. The base station controller BSC connects with a number of base transceiver stations BTS, of which only one is shown in Figure 1. The base transceiver station BTS has access to an array of radio channels for communication with a number of terminals MS, of which only one is shown in Figure 1.

The mobile switching centre MSC and the base station controller BSC are used to establish circuit switched connection between the terminal MS and a public switched telephone network or fixed network PSTN.

The GSM network PLMN shown in Figure 1 also includes a GGSN 11 (Gateway GPRS Support Node) that connects the GSM network PLMN to external packet networks, for instance to Internet. The GSM network PLMN also includes an SGSN 12 (Serving GPRS Support Node) that connects with GGSN 11 and a packet control unit PCU. SGSN 12, GGSN 11 and the packet control unit PCU are used by the packet services GPRS for switching data packets between external packet networks, such as between Internet and the terminal MS for instance. The packet control unit PCU is connected to SGSN 12 and to the radio transceiver station BTS. In a practical system, a number of packet control units are connected to SGSN 12, and a number of base transceiver stations are connected to a packet control unit PCU, although only one packet control unit and one base transceiver station have been shown for the sake of clarity.

The most important feature of this invention lies in the packet control unit and in how said unit controls the terminal MS and the base transceiver station BTS in the transmission of a stream S of packets to the terminal MS, i.e. in downlink. The packet control node PCU receives a stream of data frames DF from the Internet via GGSN 11 and SGSN 12. These data frames DF are too large to be sent over a radio connection and are therefore re-packed in the packet control node PCU in smaller radio blocks RB. The packet control unit sends the radio blocks RB to the terminal MS, via the radio transceiver station BTS. A downlink radio channel is used to transmit the stream of radio blocks RB, between the base transceiver station BTS and the terminal MS. According to GPRS, downlink and uplink transmissions are mutually separate and consequently a radio downlink RDL is separate from a radio channel RUL used for uplink connections, i.e. from the terminal MS.

An important duty of the packet control unit is link adaptation. Link adaptation involves evaluating the radio environment and the quality of the transmission over the radio link RDL and choosing for said transmission a coding procedure that is adapted according to prevailing radio conditions, so that a desired transmission quality will be maintained during transmission. The quality of the transmission and the radio environment are measured continuously to this end. The measuring procedure includes, for instance, such prevailing parameters as interference, bit error rate and signal strength. These measurements are taken in the terminal MS in respect of downlink RDL. The results of the measurements are sent in the form of measurement data reports MR in uplink RUL, i.e. from the terminal MS to the packet control node, when requested to do so by said node. The packet control node PCU asks for a measurement report MR, by including the request MR_req in a radio block RB, wherewith the radio block RB is sent downlink. Thus, in order

to obtain a measurement report MR, it is necessary for the packet control unit to first ask for such a report. This is also referred to as polling measurement reports MR.

The packet control unit evaluates or estimates the quality of the radio connection RDL downlink (link estimation) with the aid of the measurement report MR last received. The packet control unit chooses one of four alternative coding procedures that are suitable for maintaining a desired quality of the radio downlink connection in particular prevailing radio environments. A harsh coding procedure is chosen in a difficult radio environment. This results in greater redundancy in respect of data but also in a lower transmission speed for a given bit error rate at the receiving terminal MS. In good radio conditions, there is chosen a procedure that entails less coding and thus results in a higher transmission capacity at a retained bit error rate. The radio conditions will sometimes change quickly during transmission of a stream of radio blocks RB as the terminal MS moves, whereas said radio conditions are relatively static when the terminal MS is stationary.

This is an earlier known function of the GSM network PLMN.

Figures 2a and 2b each show a stream S of radio blocks RB that are sent downlink from the packet control unit. Certain of the radio blocks RB include a measurement report request MR_req and are shaded in the Figure. A measurement report MR is sent in uplink from the terminal MS to the packet control unit in response to the measurement report request MR_req.

Figure 2a illustrates, in an earlier known manner, that radio block RB which includes the measurement report request MR_req occurs at constant intervals IL.

Figure 2b shows that the measurement report request MR_req is sent in downlink from the packet control unit PCU at intervals IL of varying lengths, in accordance with the invention.

Figure 3 is a flowchart that illustrates the steps of an inventive method in choosing the length of the interval IL at which measurement reports MR are polled, depending on variations in the quality of the radio link RDL.

In a first step S1, a number of radio blocks RB are sent in a stream S downlink from the packet control unit to the terminal MS. In a following step S2, the packet control unit provides a following radio block RB in the stream S with a measurement report request MR_req, wherewith the radio block RB is sent downlink.

The terminal MS receives the measurement report request MR_req and creates a measurement report MR which is sent uplink in accordance with a following step S3. The measurement report MR is based on the results of measurements made in the terminal during the period that follows a preceding measurement report. The measurement report contains measurements of such parameters as signal strength, interference, signal variance and bit error rate during said period.

The packet control unit receives a measurement report MR in the next step S4 of the method, said measurement report being saved in a buffer. The measurement report MR is used as a basis for estimating and selecting a coding procedure in a following step S5.

The transmission of a stream S of radio blocks in downlink RDL continues. In a following step S6, a first number of radio blocks RB are again sent from the packet control unit

to the terminal MS, in the absence of a request for a measurement report MR. The first number of blocks responds to a given predetermined duration of the interval IL. The packet control unit then again includes a measurement report request MR_req in a radio block RB in said stream, in accordance with step S7.

The measurement report request MR_req is received by the terminal MS, which then creates a further measurement report MR in accordance with step S8. This further measurement report is sent in uplink.

The further measurement report MR is received by the packet control unit PCU and saved in the buffer in a following step S9. A coding procedure is then chosen for the radio link RDL in accordance with step S10. The choice is also saved in a buffer for use in a following step S11.
The variation in transmission quality is evaluated in step S11 and the duration of the interval IL is chosen on the basis of this evaluation. The duration chosen corresponds to a second number of radio blocks RB calculated from the last transmitted request MR_req for a measurement report up to and including the next radio block to be provided with a measurement report request MR_req. This evaluation, or estimation, is described below after the method steps.

In a next step S12, a second number of radio blocks RB is sent in downlink, without being provided with a request for a measurement report MR. The last of these radio blocks RB in the stream S is provided with a measurement report request in accordance with the following step S13.

The step S9 and following steps are therewith repeated in a loop.

The buffers used to save received measurement reports MR and coding procedure selections have a certain length. When the buffer is full, the oldest data saved in the buffer is discarded so as to provide room for a new measurement report and a new selected code procedure, as required.

The loop S8-S13 is broken when the flow of data frames DF ceases or when the transmission is moved to another radio channel RDL. In this latter case, the method steps are restarted with the step 1 for the new radio channel RDL.

Changes in transmission quality are evaluated as a basis for choosing said intervals. To this end, there are used the latest and earlier received measurement reports MR and also the latest and earlier selections of coding procedure. Each of Figure 4a-4d shows a diagram. The horizontal axis in all diagrams corresponds to time, although the time is not shown here in a linear scale but shall be seen as a sequence of discrete points each corresponding to a received measurement report. The Figure 4a diagram shows chosen coding procedures Cod, four alternative choices being provided.

The diagrams in Figures 4b-4d show magnitudes that have been obtained with the measurement reports MR. Figure 4b shows the signal/interference ratio C/I. Figure 4c shows the signal variances per_se, while Figure 4d shows the interference level I. A value for each of the diagrams is established in the evaluation process. For instance, a first value V_1 is established on the basis of the information in the diagram showing the signal/interference ratio C/I. The value is based on the magnitude of the differences that have occurred in the signal/interference ratio C/I in respect of a number of measurement reports, and on whether the differences show an increasing or decreasing tendency, and also on the speed and the direction of said tendency.

A second value V_2 based on the information in the diagram per_se which shows signal variance is calculated with the aid of a sliding window. The sliding window WV is shown as a broken line triangle in Figure 4b. The stacks stp accommodated in the window are each multiplied by the height of the window located above the stack, the second value V_2 is obtained by adding the products. Correspondingly, a third value V_3 is calculated on the basis of the diagram showing interference I, and a fourth value V_4 is calculated on the basis of the diagram Cod disclosing coding selection.
Each of the values V_1-V_4 is multiplied by a corresponding weighting factor k_1-k_4 and added in accordance with the following formula in order to obtain a value L:

$$L = k_1*V_1 + k_2*V_2 + k_3*V_3 + k_4*V_4$$

The interval IL in making a request for a measurement report MR is chosen on the basis of the value L. Possible values of L are pre-divided into regions that correspond to possible lengths of the interval IL.

When choosing the weighting factors k_1-k_4 in the above formula, the greatest weight will suitably be given to the fourth factor k_4, i.e. the factor that denotes the significance of the value v_4 corresponding to the coding selection diagram Cod. For instance, if the same coding has been chosen over a longer period, the greater weight should be placed on this coding and the interval IL chosen for measurement reporting should have the same length.

In Figure 5, the packet control unit PCU has been modified in accordance with the invention. The packet control unit includes a protocol converter 61 which is connected to SGSN via a Gb-interface, and to the base transceiver station BTS via an Abis-interface. The protocol converter 61 receives a stream of data frames DF in downlink, i.e. from the Gb-

interface and re-packages the information obtained from the data frames DF in radio blocks RB, which are sent in a stream S downlink. The protocol converter 61 performs the reverse operation in uplink, although the downlink is of primary interest in the case of the present invention.

The data frames DF received also include a number of control commands from SGSN 12. Some of these control signals are intended for the packet control unit PCU, while others are intended for the terminal MS. Control signals are also contained in the radio blocks RB that are transmitted in downlink and received in uplink. The purpose of the protocol converter 61 is to identify these control signals and to forward the control signals to the correct unit within the packet control unit when said signals are intended for said unit. The protocol converter 61 also delivers control signals to radio blocks RB on the command of other units within the packet control unit PCU.

Only certain control signals that are involved in link adaptation are of interest to the present invention, and consequently only these control signals will be described. Link adaptation is controlled by an own unit 62 in the packet control unit PCU. The unit 62 receives measurement reports MR that have been obtained in uplink, via a connection from the protocol converter 61. Transmission quality is evaluated in the unit 62 and a coding procedure is selected for the radio connection RDL. The choice of coding procedure Cod is sent to the protocol converter 61 via a connection. The chosen coding procedure Cod is then sent to the base transceiver station as a control signal in a radio block RB in the stream S.

The packet control unit also includes a buffer unit 63. The buffer unit 63 is coupled to the connections between the unit 62 for link adaptation and the protocol converter 61 and receives copies of the measurement reports MR and selection

of coding procedures Cod. The reported interference I, signal/interference ratio C/I, signal variance per_se and the choice of coding procedure Cod are saved in the buffer unit 63 as latest obtained values.

Connected to the buffer unit 63 is an evaluating unit 64 in which the values v_1-v_4, a value of L according to the above are calculated and an interval IL is chosen each time a new measurement report MR and selection of code Cod have been stored in the buffer unit 63.

The chosen interval IL is sent to the unit 62 for link adaptation, via a connection. Subsequent to a period corresponding to the interval IL, the unit 62 sends to the protocol converter 61 a measurement report request MR_req. The request MR_req is sent from the protocol converter 61 to the terminal MS in a radio block RB. The packet control unit need only include the buffer unit 63 and the evaluating unit 64 in order to practice the invention. Other units in the packet control unit are known to the art.

The aforedescribed components of the packet control unit are implemented as separate physical component units. Alternatively, they may have the form of software blocks controlled by a common central processor.

Each radio channel is treated separately for the connection with the terminal MS in the case of link adaptation. By radio channel is meant a given time slot on a given carrier wave for a TDMA-system such as the GSM network PLMN. GPRS enables several radio channels to be used for the connection with the terminal MS. To make this possible, the buffer unit 63 requires separate arrays of buffers for each radio channel that is link adapted.

Figure 6 illustrates the principle of the format of a radio block RB that includes a measurement report request MR_req. The radio block RB includes a number of octets each of eight bits. The initial octet is a MAC header (Medium Access Control) containing information to the effect that the following radio block RB is of the downlink radio link control type. The fifth and sixth bits of the MAC header are possibly used to indicate a measurement report request MR_req; these bits are designated "RRBP fields" in GSM terms. This is also described in specification GSM 04.60 V6.3.OE 10.2.1.

The radio block that is sent in uplink and contains a measurement report MR also includes a number of octets, the first of which is an MAC header which discloses that the radio block RB is of an uplink radio link control type. The octets in the end of the radio block RB are used for the measurement report MR. The content of the radio block RB is also referred to as an ACK/NACK-message, because it also contains an acknowledgement or no acknowledgement that a number of radio blocks have been received correctly by the terminal MS. The radio block RB that contains a measurement report MR is described in more detail in specification GSM 04.60 V6.3.OE 10.2.2.

A radio block RB contains a quantity of data intended for transmission to the terminal MS over a radio channel in four bursts. Each burst is sent in a corresponding time slot. Each time slot has a place in a corresponding TDMA-frame. Each TDMA-frame corresponds to a period of 4.6 ms and a radio block RB thus corresponds to a transmission period over the radio channel of about 20 ms. The amount of data transmitted during this period will depend on which coding procedure Cod has been chosen for the radio connection concerned. The amount of data sent in the radio block RB in downlink from

the packet control unit is adapted to the chosen coding procedure Cod.

Figure 7 illustrates a principle where the duration of the interval IL can be varied in stages of five radio blocks RB. The shortest possible duration of the interval IL is therewith five radio blocks, i.e. about 100 ms between each request MR_req for a measurement report MR and the receipt of said report. The duration IL can be increased in increments of five radio blocks RB up to a maximum interim period of fifty radio blocks RB. In the case of an interval IL of maximum duration, a measurement report request MR_req is sent each second.

As an alternative to what has been described with reference to Figure 3, the steps S4-S7 can be repeated several times before choosing the length of the interval IL is commenced. By repeating steps S4-S5 several times when beginning to use the radio channel, information is collected in the buffers from several measurement reports MR and can be used in the evaluation and selection process according to step S11.

In Figure 1, the packet control unit PCU is positioned adjacent the base station controller BSC. The packet control unit PCU is independent in relation to the base station controller BSC. A suitable implementation is to allow the packet control unit to serve the same base transceiver stations as the base station controller and to provide room for the packet control unit PCU in the same place as the base station controller BSC. The packet control unit then also manages control of the radio link for those radio channels used for data packets in a manner corresponding to the way in which the base station controller manages control of the radio link for channels used for circuit switched connections. Other architectures are also possible.

The GPRS service in a GSM network has been used in the aforegoing as an example of packet services in a mobile radio system. According to information in the literature, the GPRS service will also be included in the American mobile radio system ADC (American Digital Cellular). However, the invention is not restricted to the use solely of GPRS, but can also be applied beneficially with packet services known under other names, also implemented in other mobile radio networks than the GSM network PLMN.

It will be understood that the invention is not restricted to the aforedescribed and illustrated embodiments thereof, and that modifications can be made within the scope of the accompanying Claims.

CLAIMS

1. A packet control unit (PCU) in a cellular radio network (PLMN) designed to support a packet-orientated data service, wherein said packet control unit comprises means (61) for receiving from an external packet network data frames (DF) with a first format and for packeting received data in blocks (RB) that have a second format and for transmitting said blocks (RB) downlink, wherein said means is adapted to control a mobile terminal (MS) which receives said blocks (RB) over a radio link (RDL) and to send measurement reports (MR) concerning the measured quality of the radio link (RDL) at given intervals (IL), **characterised** by further means (62, 63, 64) which function to control the terminal (MS) to vary the duration of the intervals (IL) at which said measurement reports (MR) are sent, in accordance with the content of said measurement reports.

2. A packet control unit (PCU) according to Claim 1, wherein said further means (62, 63, 64) include a buffer unit (63) for saving the content of received measurement reports (MR).

3. A packet control unit (PCU) according to Claim 2, wherein said further means (61, 62, 63) include an evaluating unit (64) for evaluating the change in quality of the radio connection (RDL).

4. A packet control unit (PCU) according to Claim 1 or Claim 2, wherein said further means includes a link adaptation unit (64) that includes means for choosing a channel coding procedure (Cod).

5. A packet control unit (PCU) according to Claim 4, wherein the channel coding procedure (Cod) is chosen on the basis of the evaluation given in at least one of said measurement reports (MR).

6. A packet control unit (PCU) according to Claim 1, wherein the terminal (MS) is controlled to send a measurement report (MR) in response to the inclusion of a measurement report request (MR_req) in a block (RB) that is then sent on downlink.

7. A mobile radio network (PLMN) that includes a packet control unit (PCU) according to any one of Claims 1-6.

8. A method pertaining to a mobile radio network (PLMN) that supports a data packet service, said method comprising the steps of:
- transmitting downlink (S1, S2, S6, S7) a stream (S) of blocks (RB) to a receiving mobile terminal (MS), wherein a request (MR_req) for a measurement report is also sent (S7, S13) at given intervals (IL); and
- receiving (S4, S9) a measurement report (MR) in response to said request (MR_req), said report containing the result of measuring downlink transmission quality,
wherein the method is **characterised** by the further step of:
- selecting (S11) the duration of said interval (IL) on the basis of an evaluation (S) given in at least one received measurement report.

9. A method according to Claim 8, wherein said evaluation and said selection (S11) are effected each time a measurement report (MR) is received.

10. A method according to Claim 8, wherein the measurement reports (MR) are also used to chose a coding procedure (Cod) in respect of the radio connection downlink (RDL).

11. A method according to Claim 10, wherein the latest selected coding procedure (Cod) is saved for use in said evaluation and selection process (S11).

12. A method according to Claim 8, wherein a sequence of latest received measurement reports (MR) are saved for evaluation (S11).

13. A method according to Claim 8, wherein a relatively short interval (IL) is selected when a coding procedure (Cod) is changed relatively frequently, and a relatively long interval (IL) is selected when a coding procedure (Cod) is not often changed.

14. A method according to Claim 11, wherein a relatively short interval is chosen in the case of wide variations in transmission quality, and a relatively long interval is chosen in the case of small variations in transmission quality.

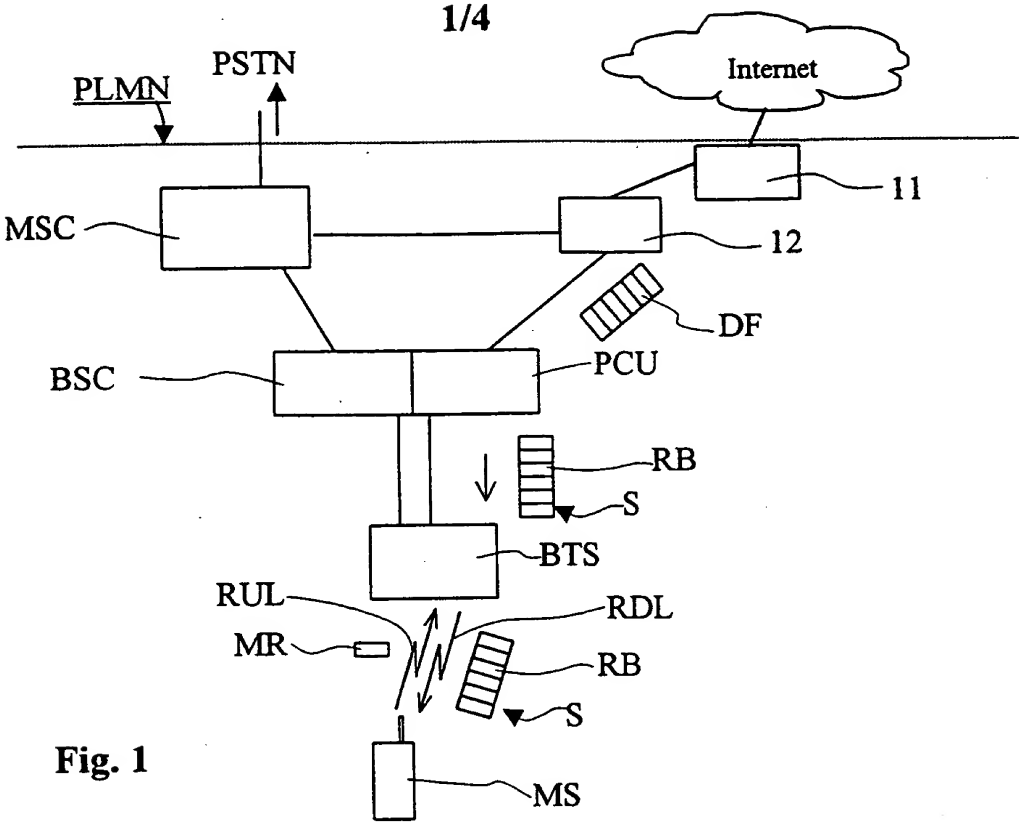

Fig. 1

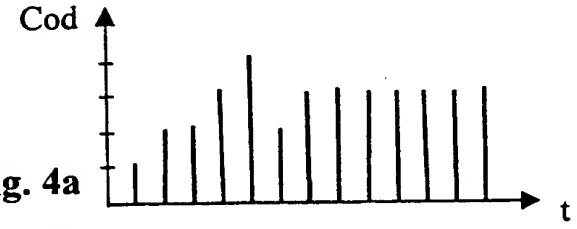

Fig. 4a

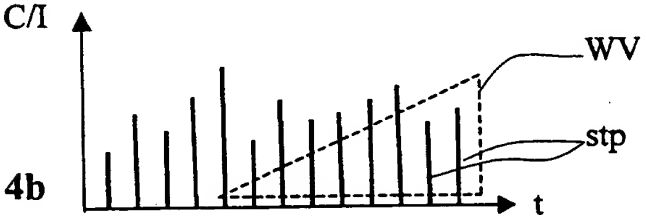

Fig. 4b

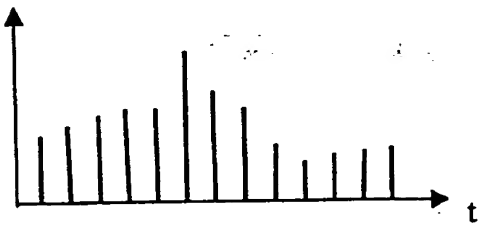

Fig. 4c

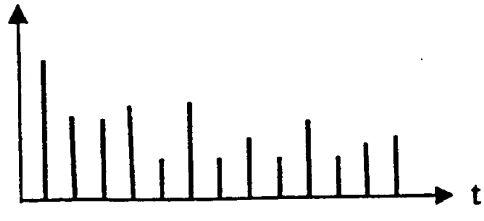

Fig. 4d

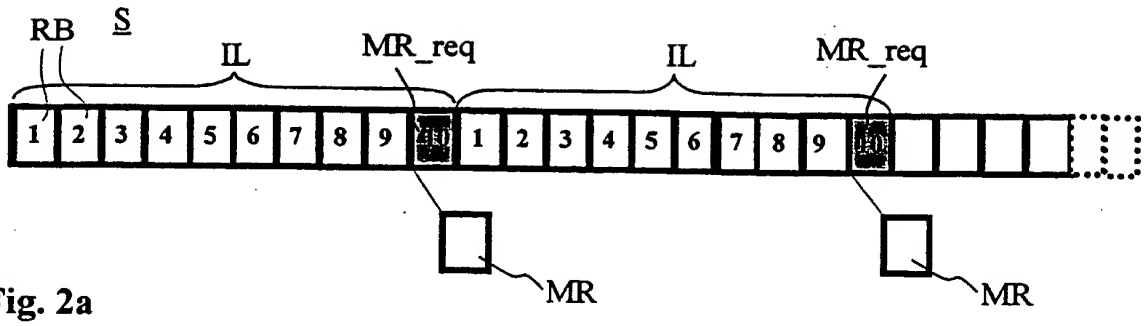

Fig. 2a

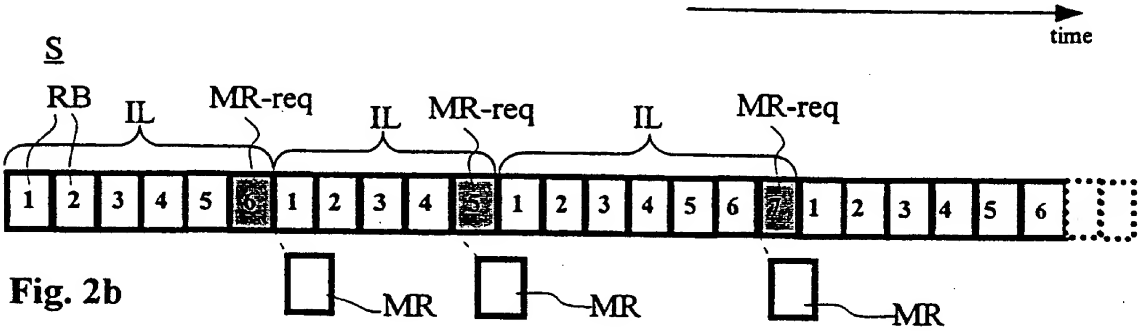

Fig. 2b

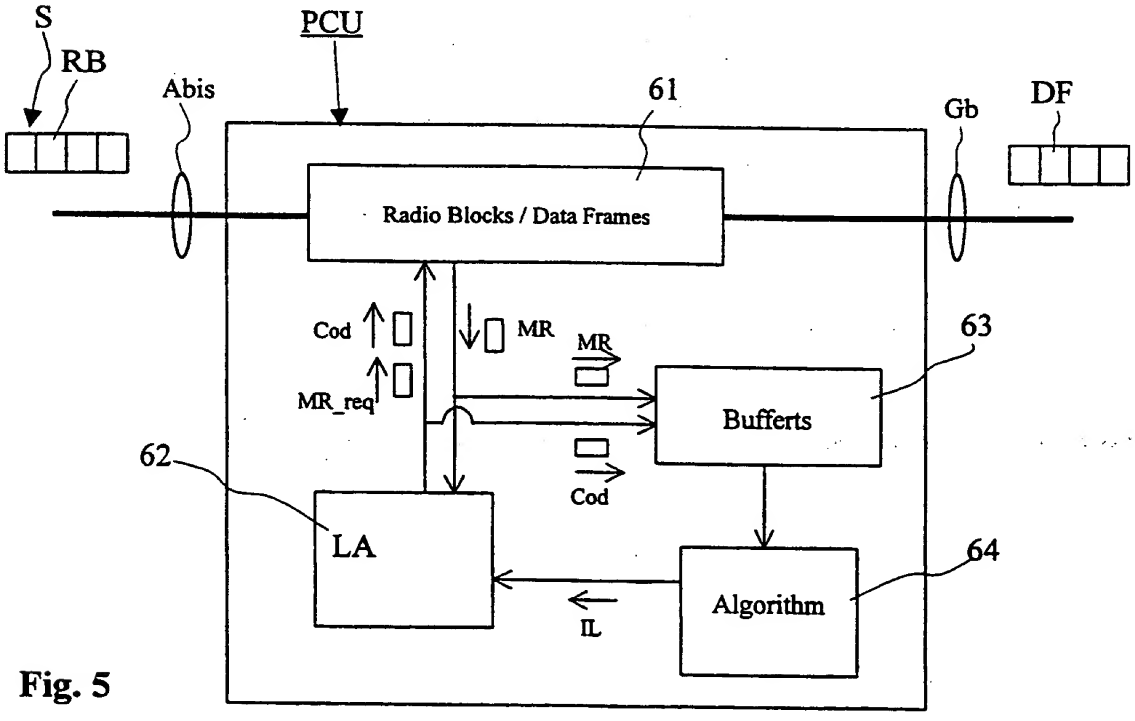

Fig. 5

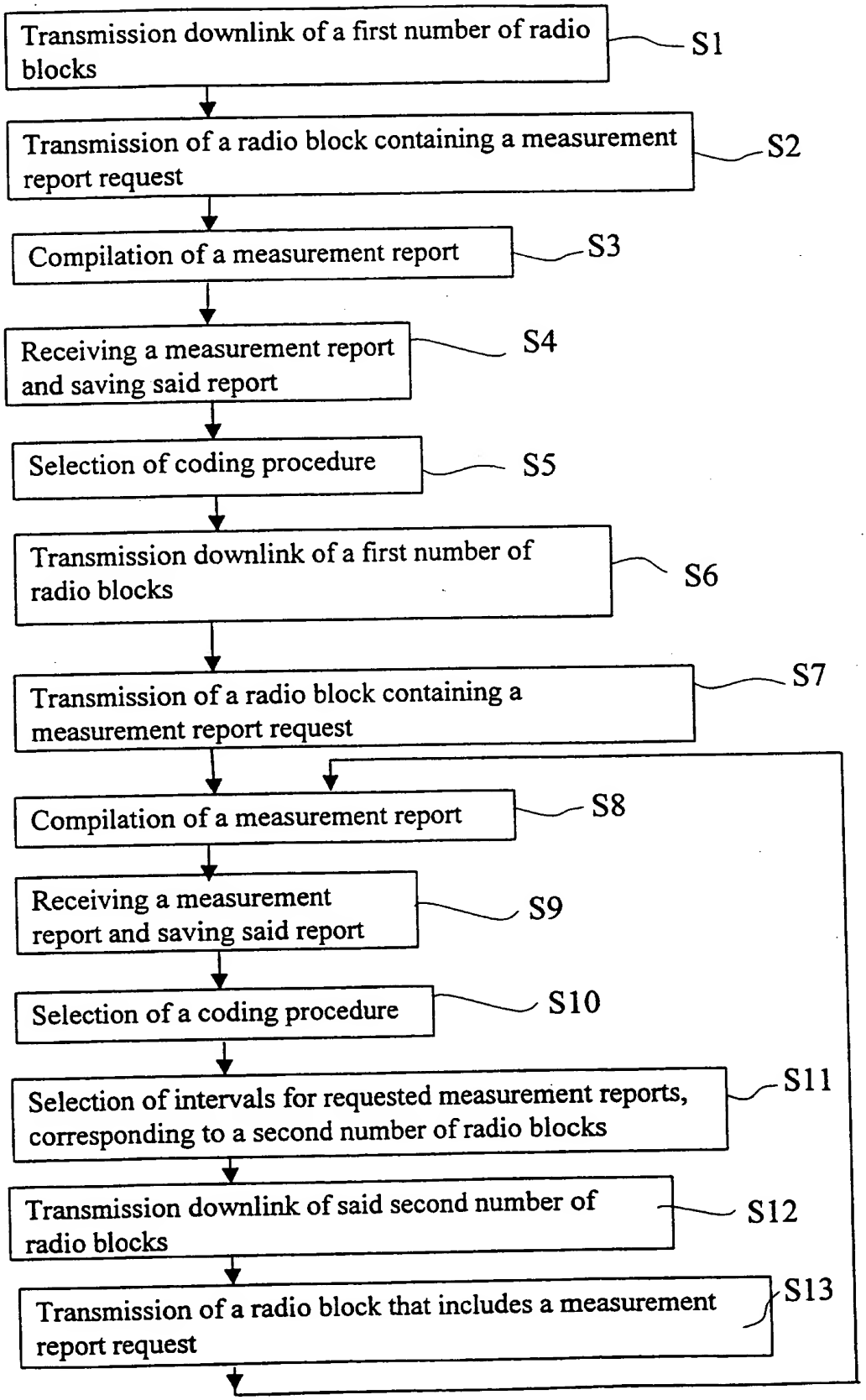

Fig. 3

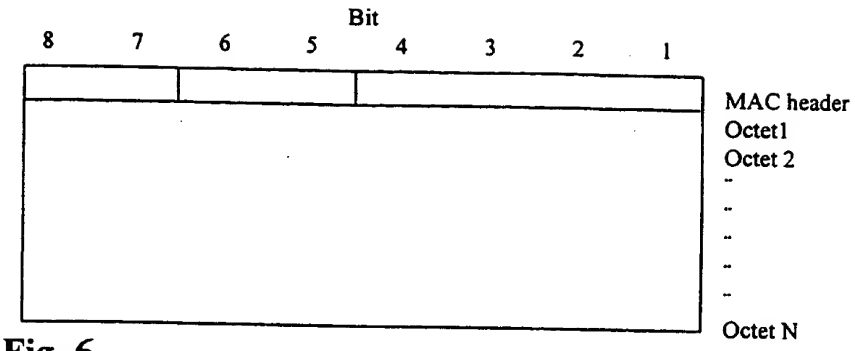

Fig. 6

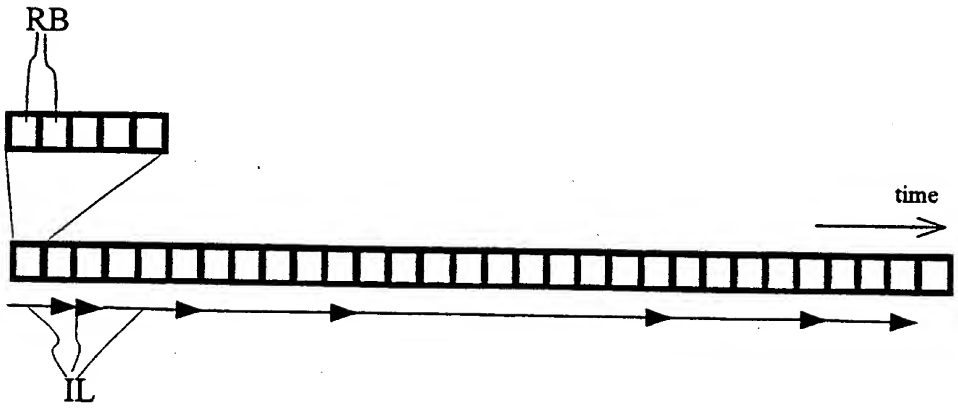

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01120

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22, H04Q 7/38
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0532485 A2 (TELEFONAKTIEBOLAGET L M ERICSSON), 17 March 1993 (17.03.93) --	1-14
A	WO 9730563 A2 (TELEFONAKTIEBOLAGET LM ERICSSON), 21 August 1997 (21.08.97) --	1-14

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 Sept 2000	26 -09- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Jack Hedlund/Els Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 00/01120

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